Nonintrusive Optical Thermometers for Real-Time Control of Fabrication Processes, Phase II

Completed Technology Project (2006 - 2009)

Project Introduction

In the proposed SBIR Phase I program LGR will develop and deploy a novel instrument ("Optical Thermometer") that provides real-time, in situ, non-contact measurements of substrate temperature in optical coating reactors. The instrument will employ an inexpensive diode laser, fiber optic components, and established laser interferometry methods to determine substrate temperature at multiple locations with a replicate precision of better than 0.01 degrees C in a measurement time of less than 0.01 seconds. The precision may be improved with increasing measurement time, if desired. The "Optical Thermometer" will be demonstrated on optical substrates made of a variety of materials in state-of-the-art industrial reactors specializing in UV, visible, near-IR and mid-IR optical coatings. The fast response of the sensor will enable coaters to use, for the first time, precise measurements of bulk substrate temperature to identify temperature nonuniformities during the coating process, refine and improve coating processes in real time, and minimize interwafer and batch-to-batch variations through closed-loop process control.

Anticipated Benefits

Potential NASA Commercial Applications: process control of optical coating reactors, control of semiconductor process (etch) reactors, temperature sensors for monitoring thermal uniformity in large-scale and small-scale optics and telescopes, and industrial processes that require ultra-high accuracy temperature measurements and real-time control based on temperature

Primary U.S. Work Locations and Key Partners

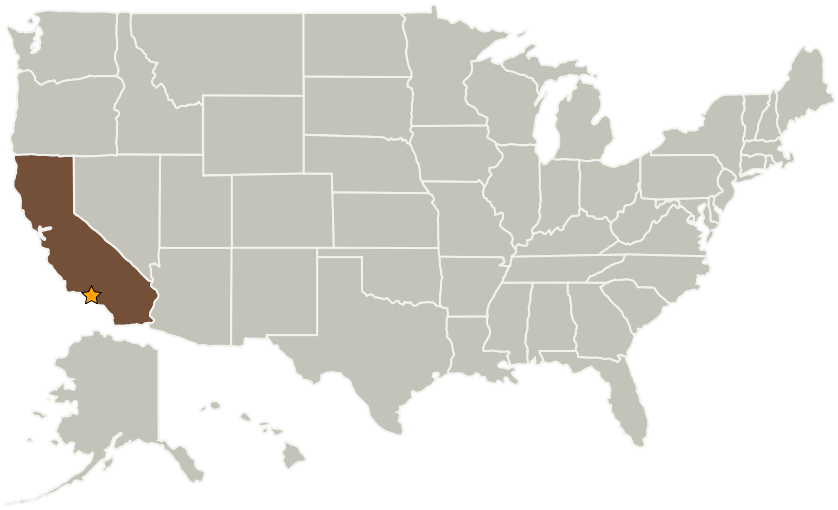

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Table of Contents

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Los Gatos Research	Supporting Organization	Industry	Mountain View, California

Primary U.S. Work Locations
California

Project Transitions

December 2006: Project Start

June 2009: Closed out

Closeout Summary: Nonintrusive Optical Thermometers for Real-Time Control of Fabrication Processes, Phase II Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

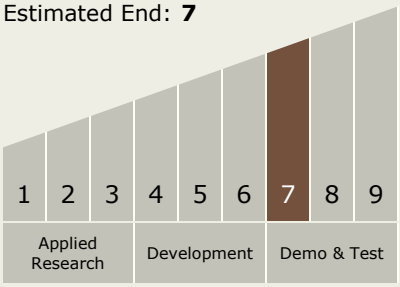
Carlos Torrez

Principal Investigator:

Douglas S Baer

Technology Maturity (TRL)

Current: **7**
Estimated End: **7**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems